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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/612,711	06/30/2003	Yuegang Zhang	884.885US1	3750

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EXAMINER

DUONG, THO V

ART UNIT PAPER NUMBER

3743

DATE MAILED: 09/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/612,711	Applicant(s) ZHANG ET AL.	
	Examiner Tho v Duong	Art Unit 3743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 June 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 19-29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 June 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-18, drawn to an invention of a heat dissipating system, classified in class 165, subclass 185.
- II. Claims 19-29, drawn to a method of manufacturing a heat dissipating system classified in class 29, subclass 890.03.

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the process as claimed can be used to make other and materially different product different such as the product not including a die and the thermal interface is separately installed between the die and the heat source.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

During a telephone conversation with Mr. Charles E. Steffey on 9/1/2004 a provisional election was made without traverse to prosecute the invention of group I, claims 1-18.

Affirmation of this election must be made by applicant in replying to this Office action. Claims

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19-29 have been withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Specification

The abstract of the disclosure is objected to because applicant elected group I, which is an apparatus group of claim, the applicant should re-write the abstract because the abstract should reflect only the invention claimed in this instant application. Correction is required. See MPEP § 608.01(b).

Content of Specification

- (a) Title of the Invention: See 37 CFR 1.72(a) and MPEP § 606. The title of the invention should be placed at the top of the first page of the specification unless the title is provided in an application data sheet. The title of the invention should be brief but technically accurate and descriptive, preferably from two to seven words may not contain more than 500 characters.
- (b) Cross-References to Related Applications: See 37 CFR 1.78 and MPEP § 201.11.
- (c) Statement Regarding Federally Sponsored Research and Development: See MPEP § 310.
- (d) Incorporation-By-Reference Of Material Submitted On a Compact Disc: The specification is required to include an incorporation-by-reference of electronic documents that are to become part of the permanent United States Patent and Trademark Office records in the file of a patent application. See 37 CFR 1.52(e)

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and MPEP § 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text were permitted as electronic documents on compact discs beginning on September 8, 2000.

Or alternatively, Reference to a "Microfiche Appendix": See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.

- (e) Background of the Invention: See MPEP § 608.01(c). The specification should set forth the Background of the Invention in two parts:
- (1) Field of the Invention: A statement of the field of art to which the invention pertains. This statement may include a paraphrasing of the applicable U.S. patent classification definitions of the subject matter of the claimed invention. This item may also be titled "Technical Field."
 - (2) Description of the Related Art including information disclosed under 37 CFR 1.97 and 37 CFR 1.98: A description of the related art known to the applicant and including, if applicable, references to specific related art and problems involved in the prior art which are solved by the applicant's invention. This item may also be titled "Background Art."
- (f) Brief Summary of the Invention: See MPEP § 608.01(d). A brief summary or general statement of the invention as set forth in 37 CFR 1.73. The summary is separate and distinct from the abstract and is directed toward the invention rather than the disclosure as a whole. The summary may point out the advantages of the invention or how it solves problems previously existent in the prior art (and preferably indicated in the Background of the Invention). In chemical cases it should point out in general terms the utility of the invention. If possible, the nature and gist of the invention or the inventive concept should be set forth. Objects of the invention should be treated briefly and only to the extent that they contribute to an understanding of the invention.
- (g) Brief Description of the Several Views of the Drawing(s): See MPEP § 608.01(f). A reference to and brief description of the drawing(s) as set forth in 37 CFR 1.74.
- (h) Detailed Description of the Invention: See MPEP § 608.01(g). A description of the preferred embodiment(s) of the invention as required in 37 CFR 1.71. The description should be as short and specific as is necessary to describe the invention adequately and accurately. Where elements or groups of elements, compounds, and processes, which are conventional and generally widely known in the field of the invention described and their exact nature or type is not necessary for an understanding and use of the invention by a person skilled in the art, they should not be described in detail. However, where particularly complicated subject matter is involved or where the elements, compounds, or

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processes may not be commonly or widely known in the field, the specification should refer to another patent or readily available publication which adequately describes the subject matter.

- (i) Claim or Claims: See 37 CFR 1.75 and MPEP § 608.01(m). The claim or claims must commence on separate sheet or electronic page (37 CFR 1.52(b)(3)). Where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation. There may be plural indentations to further segregate subcombinations or related steps. See 37 CFR 1.75 and MPEP § 608.01(i)-(p).
- (j) Abstract of the Disclosure: See MPEP § 608.01(f). A brief narrative of the disclosure as a whole in a single paragraph of 150 words or less commencing on a separate sheet following the claims. In an international application which has entered the national stage (37 CFR 1.491(b)), the applicant need not submit an abstract commencing on a separate sheet if an abstract was published with the international application under PCT Article 21. The abstract that appears on the cover page of the pamphlet published by the International Bureau (IB) of the World Intellectual Property Organization (WIPO) is the abstract that will be used by the USPTO. See MPEP § 1893.03(e).
- (k) Sequence Listing: See 37 CFR 1.821-1.825 and MPEP §§ 2421-2431. The requirement for a sequence listing applies to all sequences disclosed in a given application, whether the sequences are claimed or not. See MPEP § 2421.02.

The disclosure is objected to because of the following informalities: the summary of invention is not disclosed in the specification.

Appropriate correction is required.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the claimed subject matter of “a portion of at least some carbon nanotubes of the array of carbon nanotubes are coated with metal”; “free ends of at least some of the carbon nanotubes project from the array of carbon nanotubes to embed them in the surface of the heat spreader”; and “a circuit electrically coupled

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to the wireless transceiver” must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: the reference number “18” is described in line 3, page 5 but not shown in the drawings. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header

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(as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 6,10,11,14 and 16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claimed subject matter of "the buffer layer consists of a film selected from the group consisting of Cr, Mo, Ti W, SiC and TiC" is not described in the specification. It appears that the list of material contains only molybdenum, copper and SiC as disclosed in lines 2-3 on page 3. Furthermore, the claimed subject matter of "a circuit electrically coupled to the wireless transceiver" is not positively described in the specification. It appears in the specification that the die can be used in a wireless device but nothing relates to a circuit electrically coupled to the wireless transceiver. At last, the claimed subject matter of "a surface of the heat spreader is formed from a material having a hardness substantially less than that of the nanotubes and free ends of at least some of the carbon nanotubes project from the array of

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carbon nanotubes to embed them in the surface of the heat spreader" is not described in the specification.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 16-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 16 recites the limitation "the wireless transducer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claims 6,10,11,14 and 16 are further rejected as can be best understood by the examiner in which the group of materials, in light of the specification, is Mo, Cu and SiC and the limitation of "coupled to the wireless transceiver" means that the die is used in a wireless device. In claims 10 and 11, the examiner assumes that any conventional heat sink material is softer than the carbon nanotubes.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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Claims 1-7, and 9-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Dubin et al. (US 2004/0150100A1). Dubin discloses (figure 11) an apparatus comprising a die (22); a heat spreader (62) mounted adjacent the die; a thermal interface material interposed in a gap between the die (22) and the heat spreader; a spacer (40) with a height inserted into the gap; the thermal interface material comprising an array of aligned carbon nanotubes (48) being perpendicular to a surface of the die or the heat spreader; the nanotubes are bonded together by the spacer and a layer (38); at least one metal buffer layer (38,46) disposed between the interface material and the die (22); a buffer layer (56) is interposed between the thermal interface material (40) and the heat spreader (62); the length of at least some of the carbon nanotubes (48) slightly exceeds the width of the gaps and embedded on to a coating layer (56) of the heat spreader; and the length of the nanotubes (48) exceeds the height of the spacer (40). As regarding claims 6 and 14, Dubin discloses (paragraph 39) that a buffer layer can also be accomplished with a film of high thermal conductive material such as copper. As regarding claim 5, Dubin discloses that a bottom portion of at least some carbon nanotubes (48) is coated with a metal (46).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin in view of Mahajan (US 2002/0105071A1). Dubin discloses substantially all of applicant's claimed

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between the heat spreader and the thermal interface material, comprises a catalyst for carbon nanotube growth selected from the group of Co, Fe and Ni. Dubin discloses (figures 6,8 and paragraph 0039) that a buffer (38) includes a catalyst film of Ni, Co or Fe formed thereon for the thermal interface material (38) to grow on. Dubin discloses that the carbon nanotubes grow on the die side. Therefore, the buffer with catalyst film is disposed between the thermal interface material (38) and the die (22). However, the thermal interface material can be grown on either die side or the heat spreader side as taught by Mahajan. If the thermal interface material is grown on the heat spreader side, the buffer with catalyst film will be disposed between the thermal interface material and the heat spreader. Mahajan discloses (figure 5 and paragraph 0046) a heat dissipating device that has a thermal interface material (110) interposed between a heat spreader (112) and the die (40) wherein the thermal spreader (110) can be grown in either on the surface of the die (40) or on the lower surface of the heat spreader (122) without changing the operation of the heat dissipating device. The teaching of having at least two ways for growing the thermal interface material without changing the operation of the heat dissipating device is for the purpose of providing more ways to assembly the heat dissipating device. Since Dubin and Mahajan are both from the same field of endeavor and/or analogous art, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use Mahajan's teaching in Dubin's device for the purpose of providing more ways to assembly the heat dissipating device.

Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mahajan (US 2002/0105071A1) in view of Dubin et al. (US 20040150100A1). Mahajan discloses (figures 1, 3, paragraphs 001, 0020-0022 and 0057) a computing system, which can be a desktop, laptop, hand-held server, wireless communication device, comprising a die (40) including a die

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surface and a circuit electrically coupled to a wireless transceiver since the system is a wireless device; a heat sink (124); a thermal interface material (41) of thermal grease interposed between the die surface and the heat sink; a computer system is well known in the art to have at least one dynamic random access memory device; and the die (40) functions as microprocessor which is inherently capable of acting upon data signal. Mahajan does not disclose the thermal interface material comprises of carbon nanotubes and buffer layer. Dubin discloses (figure 11 and paragraph 0006) that a thermal interface material comprises of an array of nanotubes (48) and a buffer layer (38) coupled to the array of nanotubes is used to replace the conventional thermal interface material such as thermal grease for the purpose of reducing the thermal resistance between the die and the heat sink. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use Dubin's teaching in Mahajan's system for the purpose of reducing the thermal resistance between the die and the heat sink.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Montgomery et al. (US 2003/0117770A1) discloses a carbon nanotube thermal interface material.

Engelhardt et al. (US 2003/0179559A1) discloses an electronic component comprising carbon nanotubes.

Liberman et al. (US 2003/0135971A1) discloses a bundle draw based of carbon nanotubes.

Chiu et al. (US 6,651,736) discloses a computing system.

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Choi et al. (US 6,504,292) discloses a field emitting device comprising metallized carbon nanotubes.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Tho Duong whose telephone number is (703) 305-0768. The examiner can normally be reached on from 9:30-6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Henry Bennet, can be reached on (703) 308-0101. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0861.



TD

September 2, 2004



Tho Duong

Patent Examiner.